



TECHNICAL MEMO 5a

SUMMARY AND EVALUATION OF INTERIM SOIL TEST MATERIAL SAMPLE ANALYSIS BY PLM

1.0 INTRODUCTION

USEPA Region 8 is currently engaged in a program to test and evaluate a variety of analytical methods for quantification of asbestos in site soils, vermiculite insulation, and other related site samples. As part of this program, an initial pilot study was performed using a set of "interim soil test materials" (ISTMs) with the aim of allowing a rapid initial assessment of the relative performance of several analytical methods, including infrared spectrometry (IR), scanning electron microscopy (SEM), and polarized light microscopy (PLM) for quantifying soil concentrations in the range of 0.1% to 1%. This technical memo summarizes the PLM results for these soil-based samples. A separate memo (Technical Memo 5) summarizes the results for SEM and IR.

2.0 ISTM PREPARATION

ISTM samples submitted for analysis included a number of samples spiked with known concentrations of Libby amphibole material as well as a number of Libby field samples previously evaluated using PLM. Details of the preparation of the spiked test materials are provided in Technical Memo 5. The samples submitted for analysis and the nominal asbestos concentration values in each are shown in Table 1.

3.0 ANALYSIS

All PLM analyses were performed by Reservoirs Environmental Services, Inc. (RESI). Samples were analyzed by NIOSH Method 9002 and the mass fraction of asbestos in the samples were estimated both by the area fraction approach and by point counting.

4.0 RESULTS AND DISCUSSION

Table 2 presents the PLM results for these samples. The findings are discussed below.

4.1 Results for USGS Spiked Samples

Results for the PLM analysis of the spiked ISTM samples are summarized below:

Spiked Concentration	Area Fraction Method		Point Count Method	
	ND (<1%)	>=1%	ND	Detect
<0.5%	11	0	11	0
0.5-0.9%	12	2	6	8
>=1%	0	1	0	1

As seen, most samples (25 of 26) were spiked at a level containing less than 1% asbestos. When evaluated by the area fraction method, 23 out of the 25 samples below 1% were reported as ND, and two (nominal level = 0.5%-0.6%) were reported to contain 1% asbestos. One sample which contained a spiked level of 1.6% asbestos was reported to contain 1% asbestos.

When analyzed by the point count method, all samples with asbestos concentration below 0.5% were ND, but there was a higher detection frequency for samples in the 0.5-0.9% range. Of the 6 samples in this range that were ND, 4 of the 6 were Libby soils spiked with fine grained amphibole material. Of the nine samples that were detects, seven tended to underestimate the true concentration (see Figure 1).

4.2 Concordance with Previous PLM Results

As noted above, a total of 12 Libby field samples were submitted that had been evaluated by PLM previously. The degree of agreement (concordance) between the original analysis and the re-analysis by RESI is summarized below:

Area Fraction	ND	Trace	Quant
ND	4		
Trace	1	2	
Quant	1	3	1

Point Count	ND	Trace	Quant
ND	4		
Trace	1	2	
Quant	1	2	2

As seen, all of the samples that had previously been ranked as non-detects were also ranked as non-detects in the re-analysis by both quantitation methods. Of the three samples previously ranked as "Trace" (this indicates the sample contains asbestos, but at a level less than 1%), two were ranked as Trace by the re-analysis, and one was ranked as non-detect. Of the five samples that were previously ranked as being at or above the quantitation limit, a majority (4 out of 5 by the area fraction method, 3 out of 5 by the point count method) most were ranked as being Trace or ND during the re-analysis.

5.0 CONCLUSION

These results indicate that PLM has limited ability to provide accurate and reproducible results for soil samples than contain low levels of asbestos contamination. However, the method may have potential as a semi-quantitative technique. The point count method appears to be somewhat more accurate and sensitive than the area fraction method for samples in the 0.5-0.9% range, but still should be viewed as a semi-quantitative technique.

TABLE 1. SUMMARY OF ISTM SAMPLES

USGS ID Number	Libby Number	Soil Type	Spike material	PLM Conc	Spiked Mass %	
					Total	Asbestos
GSCD0A11		DFC	Coarse		0.1	0.08
GSCD0A60		DFC	Coarse		0.6	0.48
GSCD0B10		DFC	Coarse		0.1	0.08
GSCD0B32		DFC	Coarse		0.3	0.24
GSCD0C31		DFC	Coarse		0.3	0.24
GSCD0D82		DFC	Coarse		0.8	0.64
GSCD0F61		DFC	Coarse		0.6	0.48
GSCD0F81		DFC	Coarse		0.8	0.64
GSFD0011		DFC	Fine		0.1	0.08
GSFD0012		DFC	Fine		0.1	0.08
GSFD0031		DFC	Fine		0.3	0.24
GSFD0032		DFC	Fine		0.3	0.24
GSFD0060		DFC	Fine		0.6	0.48
GSFD0061		DFC	Fine		0.6	0.48
GSFD0081		DFC	Fine		0.8	0.64
GSFD0082		DFC	Fine		0.8	0.64
GSFDD02		DFC	Fine (dry mix)		2	1.6
GSFDDA2		DFC	Fine (dry mix)		2	1.6
GSCL0A20		Libby bkg (sieved)	Coarse		0.2	0.16
GSCL0A80		Libby bkg (sieved)	Coarse		0.8	0.64
GSCL0A81		Libby bkg (sieved)	Coarse		0.8	0.64
GSCL0B22		Libby bkg (sieved)	Coarse		0.2	0.16
GSCL0C66		Libby bkg (sieved)	Coarse		0.65	0.52
GSCL0D65		Libby bkg (sieved)	Coarse		0.65	0.52
GSCL288		Libby bkg (sieved)	Coarse		0.8	0.64
GSCL465		Libby bkg (sieved)	Coarse		0.65	0.52
GSCL802		Libby bkg (sieved)	Coarse		0.2	0.16
GSS0943C	1-00943	libby soil #0943	None	ND		
GSSA00108	A00108	libby soil #108	None	ND		
GSSA00112	A00112	libby soil #112	None	ND		
GSS103813	1-03813	libby soil #3813	None	ND		
GSSA00107	A00107	libby soil #107	None	Trace		
GSSA00110	A00110	libby soil #110	None	Trace		
GSS103806	1-03806	libby soil #3806	None	Trace		
GSS0942C	1-00942	libby soil #0942	None	1%		
GSSA00109	A00109	libby soil #109	None	1%		
GSS103808	1-03808	libby soil #3808	None	1%		
GSDM001	1-04152	Libby Soil (CDM)	None	3%		
GSDM002	1-04152	Libby Soil (CDM)	None	3%		
GSDM003	1-03407	Libby Soil (CDM)	None	5%		
GSDM004	1-03407	Libby Soil (CDM)	None	5%		

Table 2. PLM Results

Index ID	Soil Type	Spike material	PLM Conc	Spiked Mass %		RESI Results	
				Total	Asbestos	Area Fraction	Point Count
GSCD0A11	DFC	Coarse		0.1	0.08	< 1	<0.1
GSCD0B10	DFC	Coarse		0.1	0.08	< 1	<0.1
GSCD0C31	DFC	Coarse		0.3	0.24	< 1	<0.1
GSCD0B32	DFC	Coarse		0.3	0.24	< 1	<0.1
GSCD0A60	DFC	Coarse		0.6	0.48	1	0.5
GSCD0F61	DFC	Coarse		0.6	0.48	< 1	<0.1
GSCD0F81	DFC	Coarse		0.8	0.64	< 1	0.3
GSCD0D82	DFC	Coarse		0.8	0.64	1	0.3
GSFD0011	DFC	Fine		0.1	0.08	< 1	<0.1
GSFD0012	DFC	Fine		0.1	0.08	< 1	<0.1
GSFD0031	DFC	Fine		0.3	0.24	< 1	<0.1
GSFD0032	DFC	Fine		0.3	0.24	< 1	<0.1
GSFD0060	DFC	Fine		0.6	0.48	< 1	<0.1
GSFD0061	DFC	Fine		0.6	0.48	< 1	<0.1
GSFD0081	DFC	Fine		0.8	0.64	< 1	<0.1
GSFD0082	DFC	Fine		0.8	0.64	< 1	<0.1
GSFDD02	DFC	Fine (dry mix)		2.0	1.6	1	0.8
GSCL0A20	Libby bkg (sieved)	Coarse		0.2	0.16	< 1	<0.1
GSCL0B22	Libby bkg (sieved)	Coarse		0.2	0.16	< 1	<0.1
GSCL802	Libby bkg (sieved)	Coarse		0.2	0.16	< 1	<0.1
GSCL0C66	Libby bkg (sieved)	Coarse		0.65	0.52	< 1	0.1
GSCL0D65	Libby bkg (sieved)	Coarse		0.65	0.52	< 1	<0.1
GSCL465	Libby bkg (sieved)	Coarse		0.65	0.52	< 1	0.1
GSCL0A80	Libby bkg (sieved)	Coarse		0.8	0.64	< 1	0.1
GSCL0A81	Libby bkg (sieved)	Coarse		0.8	0.64	< 1	0.9
GSCL288	Libby bkg (sieved)	Coarse		0.8	0.64	< 1	0.4
GSS0943C	libby soil #0943	None	ND			ND	ND
GSSA00108	libby soil #108	None	ND			ND	ND
GSSA00112	libby soil #112	None	ND			ND	ND
GSS103813	libby soil #3813	None	ND			ND	ND
GSSA00107	libby soil #107	None	Trace			ND	ND
GSSA00110	libby soil #110	None	Trace			< 1	<0.1
GSS103806	libby soil #3806	None	Trace			< 1	<0.1
GSS0942C	libby soil #0942	None	1%			< 1	0.3
GSSA00109	libby soil #109	None	1%			< 1	<0.1
GSS103808	libby soil #3808	None	1%			ND	ND
GSDM001	Libby Soil (CDM)	None	3%			1	0.7
GSDM002	Libby Soil (CDM)	None	3%			< 1	<0.1

Figure 1. PLM Point Count Results

